The Paleontograph

A newsletter for those interested in all aspects of Paleontology
Volume 8 Issue 2 May, 2019

From Your Editor

Welcome to our latest edition. The good weather is here and I am looking forward to some time in the field. My annual trip to Kansas had to be cancelled due to bad weather so I am extra excited to be going for dinosaur material in South Dakota in a couple weeks.

We have many good articles for you in this issue including one from a new author. I hope you enjoy them.

For those of you that missed the news, I have a note on the last page detailing an exciting new arrangement. We now have all back and future issues of The Paleontograph archived on the AAPS website.

The Paleontograph was created in 2012 to continue what was originally the newsletter of The New Jersey Paleontological Society. The Paleontograph publishes articles, book reviews, personal accounts, and anything else that relates to Paleontology and fossils. Feel free to submit both technical and non-technical work. We try to appeal to a wide range of people interested in fossils. Articles about localities, specific types of fossils, fossil preparation, shows or events, museum displays, field trips, websites are all welcome.

This newsletter is meant to be one by and for the readers. Issues will come out when there is enough content to fill an issue. I encourage all to submit contributions. It will be interesting, informative and fun to read. It can become whatever the readers and contributors want it to be, so it will be a work in progress. TC, January 2012

Edited by Tom Caggiano and distributed at no charge

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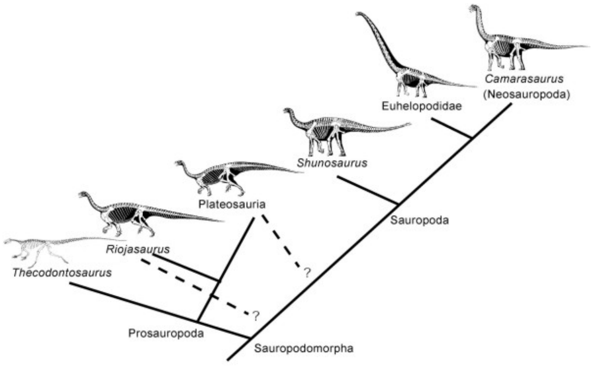
Prosauropods to Sauropods

Bob Sheridan December 28, 2018

Prosauropods are herbivorous saurischian dinosaurs from the Triassic and Early Jurassic. They are found world-wide. There are somewhere between 12 and 18 genera, depending on how one classifies the more incomplete specimens. The most famous genus is probably Plateosaurus, which is known from the Latest Triassic of Europe and North America. Plateosaurus is also one of the first dinosaurs discovered (1834). Prosauropods have small elongated heads with leaf-shaped teeth with large serrations, a longish neck, a fairly long body, and a long tail. Their forelimbs are generally much shorter than their hindlimbs, indicating they were primarily bipedal, but it is often argued that they could be quadrupedal at least some of the time. Prosauropods were some of the largest dinosaurs in the Triassic (up to 4 metric tons).



Sauropods are huge (10s of metric tons), extremely long-necked (up to 15 meters) herbivorous dinosaurs which arose in the Middle Jurassic. Sauropods are completely quadrupedal with cylindrical limb bones and very short feet, consistent with bearing their great weight. The general evolutionary trend for prosauropods with time is to attain longer necks, larger sizes, more robust feet, and larger front limbs, so the classic idea that prosauropods were the direct ancestors of sauropods seems plausible. Hence, prosauropods and sauropods are collectively called "sauropodomorphs." We should be able to pinpoint when the prosauropod-like anatomy transitions into sauropod-like anatomy. However, as with many seemingly plausible evolutionary ideas, we have too few specimens or the specimens are too incomplete to be sure the idea is correct, and there remain big gaps to fill.

Two discoveries from 2018 add to our knowledge of prosauropods. Muller et al. (2018) describe three specimens from Late Triassic of Brazil, which they have named *Macrocollum itaqui* ("long neck"). The best specimen of Macrocollum is almost complete and articulated. Macrocollum is small to medium sized, and very similar to Unaysaurus, another prosauropod from Brazil. The most unique aspect of Macrocollum is that the cervical vertebrae are much longer than seen in other prosauropods from the same time period, so it is the earliest prosauropod with a long neck. The authors also note that in Macrocollum the femur is on the border of being longer than the tibia, indicating that prosauropods are evolving away from being fast runners.

McPhee et al. (2018) describe new prosauropod material from South Africa which they named *Ledumahadi mafube* ("dawn of the giant thunderclap"). The date on the formation where the specimen was found 200-195 Myr. which would be Early Jurassic The specimen is very fragmentary: a few vertebrae, and parts of the limbs. However, that is enough to draw some conclusions. Bone histology indicates this specimen as about 14 years old and fully grown. Ledumahadi is very large for a prosauropod, estimated at 12 metric tons. Also, it is possible to estimate the circumference of the arm and leg bones. In bipedal dinosaurs and most prosauropods, the forelimbs are smaller than the hindlimbs. However, in Ledumahadi the forelimbs are about equal in circumference to the hindlimbs, more consistent with the ratio observed in sauropods. Phylogenetic analysis would put Ledumahadi close to another Early Jurassic prosauropod Antetonitrus, also from South Africa. The authors point out that the shapes of the forelimb bones of Ledumahadi are much like that expected for prosauropods and not like the columnar limbs of sauropods. This implies that large size preceded columnar limbs in sauropod evolution.

Sources:

McPhee, B.W.; Benson, R.B.J.; Botha-Brink, J.; Bordy, E.M.; Choiniere, J.N.
"A giant dinosaur from the Earliest Jurassic of South Africa and the transition to quadrupedality in Early Sauropodomorphs"
2018, Current Biology 28, 1–9.

Muller, R.T.; Langer, M.C.; Dias-da-Silva, S.
"An exceptionally preserved association of complete dinosaur skeletons reveals the oldest long-necked sauropodomorphs."
Biol. Lett. 14: 20180633.

A Curious New Horseshoe Crab from the Alps of Northern Slovenia

Russell D. C. Bicknell

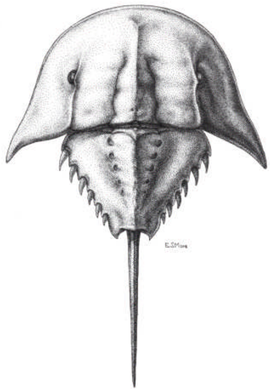
Horseshoe crabs are one of the largest chelicerate arthropods groups alive today and are distributed along the east coasts of the USA, China, and Japan and within Indonesia. True horseshoe crabs (Xiphosurida) have a fossil record spanning back to at least the upper Devonian and horseshoe crabs *sensu lato* have been documented in rocks from the Lower Ordovician.

A problem that paleontologists interested in horseshoe crabs face is that the cuticular exoskeleton of the group requires exceptional preservation for specimens to be saved in the fossil record. To this end, the horseshoe crab fossil record has been documented somewhat sporadically over the past ~150 years. Furthermore, interest in horseshoe crabs fluctuates: on an almost decadal cycle research in the group peaks and then drops off. The recent pulse in horseshoe crab research has seen a re-evaluation of the evolutionary history of the group (Lamsdell, 2013, 2016).

To align with this recent work, somewhat fortuitously, new exceptional preservation sites housing horseshoe crabs have been identified.

Sloveniolimulus rudkini

One such site is a Triassic aged marine deposit found in the northern Alps of Slovenia. I came across a photograph of a specimen in a Križnar and Hitij (2010) where it was not described in detail and assigned to a possible family. I have since had the fortune to work on the specimen with the researchers who originally found it. We concluded that it was unique enough to erect the new genus and species *Sloveniolimulus rudkini* in *Geological Magazine* this year (Bicknell et al.,2019). The specimen was used to explore the evolution of horseshoe crabs across the Carboniferous to today. We highlighted that the Triassic was a period when horseshoe crab diversity peaked, at least within limulids, paleolimulids and austrolimulids. This work is just beginning to scratch the surface of horseshoe crab evolution and discover how these organisms survived five mass extinctions. Describing and naming new species is a key direction that can be used to uncover the stories behind these still enigmatic creatures hold.



Reconstruction of *Sloveniolimulus rudkini* by Elissa Martin

Sources used

Bicknell RDC, Žalohar J, MiklavcP, CelarcB, KrižnarM, and HitijT.
A new limulid genus from the Strelovec Formation (Middle Triassic, Anisian) of northern Slovenia.
Geological Magazine
https://doi.org/10.1017/S0016756819000323

Križnar, M., & Hitij, T. (2010). Nevretenčarji (Invertebrates) Strelovške formacije.
The kingdom of Tethys, the fossilized world of Triassic vertebrates from the Kamnič-Savinjske Alps: Scopolia supplement*, 5*, 91–107.

Lamsdell, J. C. (2013).
Revised systematics of Palaeozoic 'horseshoe crabs' and the myth of monophyletic Xiphosura.
Zoological Journal of the Linnean Society,
167, 1–27.

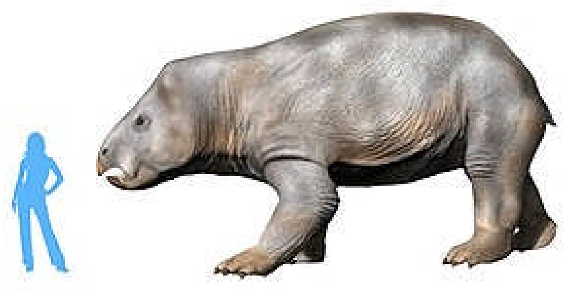
Lamsdell, J. C. (2016).
Horseshoe crab phylogeny and independent colonizations of fresh water: ecological invasion as a driver for morphological innovation.
Palaeontology, *59*, 181–194.

Lisowicia

Bob Sheridan December 8, 2018

Dicynodonts ("two dog teeth") are a branch of herbivorous mammal-like reptiles that arose in the Middle Permian. Most became extinct at the End-Permian extinction, but one example may have lasted until the Early Cretaceous, although this is controversial. Generally, they have barrel-shaped bodies with short powerful legs. Almost all had toothless beaks and two large tusks in the upper jaw, hence the name. It is plausible that they had some kind of hair. One aspect that will be important for our story is the disposition of the limbs. The hindlimbs were generally held directly under the body as in modern mammals, but the forelimbs were held out to the side, similar to modern reptiles. Another important aspect is their size, typically in the range of 100 pounds to 2 tons.

Sulej and Neidiwiedzki (2018) describe a new dicynodont from the Late Triassic of Poland. This animal given the name *Lisowicia bojani* (named for the village Lisowice and Ludwig Heinrich Bojanus, a German physician and naturalist). The specimen has a mostly complete shoulder girdle, pelvis, and limbs. Only fragments of the skull are preserved, but the fragments include one tusk. The most important thing about Lisowicia is its size: an estimated 4.5 meters long and a mass of 9 metric tons, i.e. elephant size. This makes it, not only by far the largest dicynodont, but the largest land animal in the Triassic. It is also the youngest non-disputed dicynodont.



Another unusual aspect is the structure of the shoulder girdle and humerus. The authors feel they are consistent with a full upright position of the forelimbs, which anticipates the upright forelimbs of the giant dinosaurs, but is unknown in other dicynodonts.

Bone histology of most dicynodonts indicate a rapid growth rate, but there is evidence of slowed growth at sexual maturity, very much like modern mammals. However, there is no sign of slowed growth in the Lisowicia specimen, which could indicate that the specimen is young or continues to grow as an adult.

Sources:
Sulej, T.; Niediwiedzki, G.
"An elephant-sized Late Triassic synapsid with erect limbs."
Science 2019, 363, 78-80.

Vogel, G.
"Giant mammal cousin rivaled early dinosaurs."
Science 2018, 352, pp. 879.

Coprolites of Smok

Bob Sheridan February 12, 2019

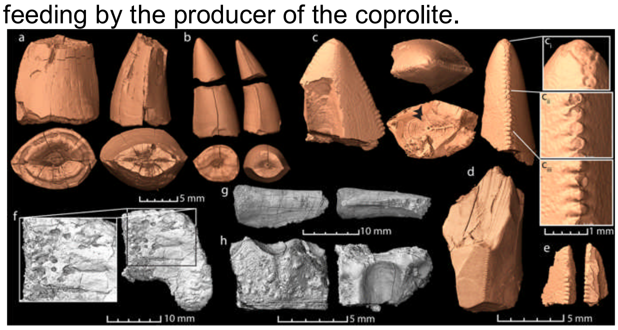
Smok ("dragon" in Polish) is a very unusual creature from the Late Triassic (205-200 Myr.) of Poland. It closely resembles a medium-sized (5-6 meters) theropod dinosaur. It has a bipedal stance, and a long head with sharp serrated teeth. It also has three toes and three fingers like a theropod. Indeed it was first described as a dinosaur. However, further work have put its dinosaur status in doubt. While it is indeed an archosaur (the group of reptiles that contains crocodiles, pterosaurs, and dinosaurs, including birds), it has more characteristics of crocodilian archosaurs than with dinosaurs. Crocodilians were very varied and common in the Triassic, and included some fairly large (quadrupedal) predators like Prestosuchus. Smok may be an example of a crocodilian mimicking a theropod through convergent evolution.

Qvarnstrom et al. (2019) describe a series of 10 coprolites from the same strata as the Smok fossil. The same strata also contains footprints. Since the coprolites and footprints are large enough for Smok, and since no other predatory animal of the same size is known from that same time and place, both have been assigned to Smok. These coprolites are cylindrical and between 9 and 25 centimeters long. The main method of study here is CT-scanning, which can produce a 3D model. Most of the coprolites contain bone fragments (sometimes up to 50% of the volume of the coprolite) and three contain broken teeth. Such bone-filled coprolites have not been previously known from the Triassic.

Cont'd

Smok Copro Cont'd

Some of the bone fragments (millimeters to a few centimeters in size) are recognizable, specifically a dermal bone of a temnospondyl amphibian and the humerus of a juvenile dicynodont. There are also fish remains and mineral grains. The teeth, identical to those known from Smok skeletons, are in various stages of wear and digestion. They were almost certainly accidentally broken and swallowed during feeding by the producer of the coprolite.



The authors point out that the only other archosaur that shows bone fragments in coprolites assigned to it are tyrannosaurs, which Smok precedes by 240 Myr.

Sources:

Qvarnström, M.; Ahlberg, P.E.; Niedźwiedzki, G. Tyrannosaurid-like osteophagy by a triassic archosaur.
Nature Scientific Reports 2019, 9, 925.

Cretoxyrhina and Pteranodon

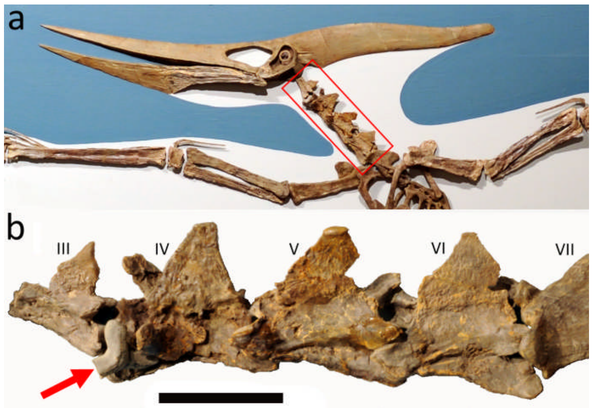
Bob Sheridan January 12, 2019

Pteranodon is a very well-known, large (wingspans of up to 20 feet) Late Cretaceous pterosaur with a toothless beak and a large crest. There have been up to 11 species of Pteranodon named, but there may be as few as two: *Pteranodon longiceps* and *Pteranodon sternbergi*, which differ by the shape of the crest. Other "species" might be variations in size vs. time or represent the sexes. Most Pteranodon specimens (of which there are upward of 1000) are from the Niobrara Formation of the central US, which is marine sediment deposited in the Western Interior Seaway. The aspect ratio of Pteranodon wings suggest it spend most of the time soaring, much like a modern albatross.

There is evidence that Pteranodon ate fish, based on the stomach contents of some specimens, and Pteranodon bones have been found in the stomach contents of marine animals. Hone et al. (2018) describe new evidence for a predator-prey relationship involving Pteranodon. This is based on a specimen LACM 50926 which is in a glass display case at the Los Angelos County Museum of Natural History. The mount is probably a composite of several specimens, of somewhat different sizes, collected in 1965 from the Niobrara Chalk of Kansas, which would make it 86-83 Myr. old. The species is probably longiceps, but this is not certain.

The most interesting feature of LACM 50926 is a series of five cervical vertebrae (III to VII—the neck is not complete). The size of the vertebrae would imply a wingspan of 15ft for this specimen. There appears to be a shark tooth wedged between vertebrae III and IV, with the tooth pointing backward. The tooth is approximately 1 inch in height including crown and root.

The crown is moderately narrow flattened subtriangle. The root has the usual semi-lunate shape (shaped like a fat crescent). The authors point to the shark *Cretoxyrhina mantelli* (sometimes called the "ginsu shark") as having teeth most like the tooth in LACM 50926 and as living at the same time and place as LACM 50926. Cretoxyrhina is thought to have a length of about 20ft, roughly the same as a great white shark.



An illustration in the paper shows Cretoxyrhina breaching out of the ocean and grabbing a Pteranodon out of the air by the neck. However, this dramatic scene seems unlikely (the caption refers to a "juvenile impulse of the artist"). It is more likely that the Pteranodon was already dead and its carcass floating on the surface of the water when the shark scavenged it.

Sources:

Hone, D.W.E.; Witton, M.P.; Habib, M.B.
"Evidence for the Cretaceous shark *Cretoxyrhina mantelli* feeding on the pterosaur Pteranodon from the Niobrara Formation."
PeerJ, 2019, 6, e6031.

Basilosaurus and Dorudon

Bob Sheridan January 13, 2019

Today's story is about early whales. Basilosaurus ("king lizard") lived in the Late Eocene (40-35 Myr.). It has a very long (perhaps 60ft) eel-like body because the vertebrae in the chest, back, and tail are unusually elongated. Remains have been recovered from the United States and Egypt. (It is the state fossil of Mississippi and Alabama.) Basilosaurus is has many modern toothed-whale features such as a partly detached ear bone, an asymmetrical skull (presumed helpful for echolocation), and detached pelvic bones (although tiny fully-formed legs are present). Dorudon ("spear toothed") is a smaller (16ft) contemporanous early predatory whale with somewhat similar features to Basilosaurus, except not as elongated in shape. (In fact early on it was speculated that Dorudon represented juvenile Basilosaurus.)

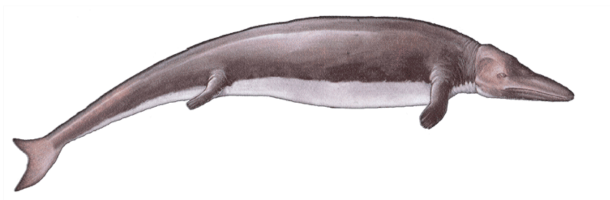
Basilosaurus skull

To my eyes, these early whales superficially resemble mosasaurs more than modern whales with their deep chests, long bodies, and long triangular heads with large blade-like teeth. Modern toothed whales have rounded foreheads due to a fatty "melon" they use to focus sounds for echolocation, and there is usually a concavity in the front of the skull to contain it. The early whales lack these concavities. Unlike mosasaurs, of course, the early whales swam by moving the tail up and down instead of side-to-side.

Both Basilosaurus and Dorudon are found in the Wadi Al Hitan site in Egypt. Almost all the Basilosaurus seem to be adults, judged by whether their permanent teeth are in place. In contrast, there are both adults and juvenile Dorudons present, which suggests this site might be a calving area for Dorudon. There is some suggestion that Basilosaurus preyed upon Dorudon, based on bite marks, but of course, that is fairly ambiguous evidence.

Voss et al. describe a new partial skeleton of Basilosaurus from Wadi Al Hitan called WH1001, which is dated to ~37Myr. This skeleton is 67% complete but disarticulated and scattered. There are skull fragments, teeth, ribs and vertebrae present. The interpretation of the authors is that this specimen died, fell to the ocean floor and was disturbed by scavengers and currents. The wear on the teeth suggests and adult or very old animal. There is only one Basilosaurus present based on the fact that there are no duplicated bones.

The most interesting things about the specimen is that there are 13 fragments of Dorudon bones mixed among the Basilosaurus bones, including jaw elements, cranial bones, teeth, vertebrae, and ribs. Some of these bones seem to have bite marks. These are small enough to be assignable to a juvenile Dorudon about 2 meters long. Since there are no other skeletons near the Basilosaurus, it seems plausible that the Dorudon bones represent "stomach contents."



Durodon reconstruction

Also in the Basilosaurus are remains teeth from the ray-finned fish Pycnodus and the shark Charcharocles. Since Pycnodus is small and has crushing teeth, it is assumed that it was eaten by the Basilosaurus. On the other hand, Charcharocles is a large shark, and less likely to be prey. It is more likely that the tooth is evidence that Carcharocles scavenged the Basilosaurus after it died.

This is by no means the first stomach contents discovered for Basilosaurus. However, these findings suggest unambiguously that Basilosaurus was an apex predator of the Eocene that preyed on other whales, much like modern killer whales.

Sources:

Voss, M; Antar,S.M.; Zalmout, I.S.; Gingerich, P.D. "Stomach contents of the archaeocete *Basilosaurus isis*: Apex predator in oceans of the late Eocene."
PLoS ONE 2019, 14(1): e0209021

Moros, A New North American Tyrannosauroid

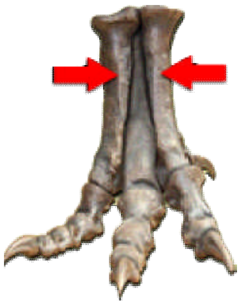
Bob Sheridan March 14, 2019

Tyrannosauroids (the branch of theropod dinosaurs that includes Tyrannosaurus) are on my mind recently. A week ago I attended a member's preview for the "T. rex: The Ultimate Predator" exhibit at the American Museum of Natural History. The April 2019 issue of Discover magazine has an article "Meet the T-rex Family." Finally I came across a paper by Zanno et al. (2019) describing a new tyrannosauroid from North America.

Reconstruction of Moros

A little background. Until a few decades ago, we thought of tyrannosaurs as large (10-15 meters long) predators of the Late Cretaceous mostly from North America (what are called "tyrannosaurids"), for example Tyrannosaurus, Albertosaurus, Gorgosaurus, and Daspletosaurus. (It is still a matter of controversy of whether Tarbosaurus deserves its own genus or is just an Asian variant of Tyrannosaurus.) Characteristic of these animals are: large heads with wide-set eyes, tiny arms, large-spike-like teeth. Now we know that tyrannosauroids constitute a large family (~30 genera) that goes back to the Late Jurassic. Tyrannosaurs and can be found in Asia, Europe, and both sides of North America. They vary in size, robustness, length of arms, and shape of the teeth. Some have three fingers, and some have bony crests. We also know that at least some of the earlier tyrannosauroids were feathered, as indicated by specimens from China. (A special note to those of use with New Jersey roots: Dryptosaurus, first described in 1861, was not accepted as a tyrannosauroid until 2005.) It is a topic of current study as to when and how these animals transitioned from small, slender marginal predators to giant, robust ones at the top of the food chain. Complicating the study is that it is not always easy to tell a new species from a juvenile form of a known species, since anatomical characteristics change as animals grow up. For example, it is still a matter of discussion whether "Nanotyrannus" is its own genus or a juvenile Tyrannosaurus.

Zanno et al. describe a new specimen from Utah which they named *Moros intrepedus* (named for the Greek god of impending doom and "intrepid"). The formation in which the specimen was found is dated ~97 Myr. The specimen consists of a few premaxillary teeth and elements of the right hind limb. Moros would be a small theropod, at most 3 meters long. Bone histology suggests the Moros specimen was 6-7 years old and nearing maturity, suggesting it is not a juvenile of some other species. The fact that the tibia is much longer than the femur, and the fact that the leg bones are very slender suggests Moros was a fast runner. Details of these bones are enough to establish Moros as a tyrannosauroid, probably related to mid-Cretaceous Asian forms as Xiongguanlong. The arctometatarsal condition in Moros is not as extreme in Moros vs. some other tyrannosauroids. ("Arctometatarsal" means the middle metatarsal is pinched between the flanking metatarsals. This is common in tyrannosauroids, but also some other theropods.)



Moros represents the smallest Cretaceous tyrannosauroid, and the oldest in North America. The fact that it resembles older Asian forms is consistent with the hypothesis that tyrannosauroids originated in Asia and migrated to North America. Plus it indicates that North American tyrannosauroids were still small as late as the Mid-Cretaceous.

Sources:

Zanno, L.E.; Tucker, R.T.; Canoville, A.; Avrahami, H.M.; Gates, T.A.; Makovicky, P.J. "Dimunitieve fleet-footed tyrannosauroid narrows the 70-million-year gap in the North American fossil record." Commun. Biol. 2019, 2, 64.

Direct Evidence of Keratin in Fossil Feathers

Bob Sheridan February 1, 2019

Keratin is a fibrous protein found in vertebrate integument: horns, hooves, nails, beaks, skin, hair, and feathers. There are two families of keratin: alpha and beta. Alpha is found in all vertebrates and beta is found mostly in reptiles and birds. Beta-keratin in feathers is distinct from other beta-keratins. The flexibility of individual keratin molecules, determining whether keratin-containing tissue is hard or soft, is determined by the number of disulfide bonds cross-linking parts of the protein.

Keratin is very stable. Schweitzer et al. (2018) tested this idea by burying modern feathers for 10 years and/or subjecting them to high heat (up to 350 Celsius), as a surrogate for fossilization. The characteristics of keratin, including microscopic structure and the ability to react with anti-keratin antibodies, survived such mistreatment. However, the melanosomes (microscopic pigment containing bodies) did not always survive. This makes it plausible that keratin could be detected in fossils.

Theropod dinosaurs and early birds have a variety of feather types, ranging from hair-like filaments to fully modern-looking flight feathers. Flight feathers need to have a minimum stiffness to support the weight of the bird, and it is an interesting question as to when that happened in bird evolution.

A paper from Pan et al. (2019) investigates keratin in a number of fossils and extant animals using a variety of techniques. The fossils are specimens of: Anchiornis (a proto-bird much like Archaeopteryx but older), Eoconfuciusornis (an early bird), Yanoris (an early bird), Shuvuuia (an alvarezsaurid dinosaur), and Citipati (an oviraptor dinosaur). Also included is a feather specimen from an unspecified dromaeosaur. Anchiornis is from the Late Jurassic; the other fossils are from the Early Cretaceous. The extant specimens include feathers and claws from chickens, emus, and ostriches.

Specimens are examined by scanning electron microscopy (SEM), a type of transmission electron microscopy (TEM) that allows for analysis of chemical elements, and immunohistochemistry. Immunohistochemistry is the art of producing antibodies against specific proteins (in this case varieties of keratin) such that the antibodies are made detectable by attaching a fluorescent “reporter” group. One can detect if a specific protein is present in a specimen if the antibody sticks and fluorescence is observed.

By SEM, there are some differences between feathers of living birds and the feathers of the specimen of Anchiornis. Modern feathers and Anchiornis feathers show short and thin filaments about 3 micrometers in diameter (expected for beta-keratin), while the Anchiornis feathers also show thick filaments about 8 micrometers in diameter (expected for alpha-keratin). Both fossil and extant feathers have melanosomes, ovoid particles that carry pigment.

No non-keratin antibodies bind to any feather specimen, and no keratin-antibodies bind to the rock matrix, indicating there are no false hits with the technique. Beta-keratin antibodies bind to all fossil feather specimens, indicating that keratin is preserved intact. Feather-specific beta-keratin antibodies bind to modern bird feathers, Yanornis, and Eoconfusciusornis, Anchiornis, and the unspecified dromaeosaur feather. Alpha-keratin specific antibodies bind to Eoconfusciusornis, Anchiornis, and the unspecified dromaeosaur. The fact that the dinosaurs Suvuuia and Citipati show beta-keratin implies that that molecule was already present in dinosaurs, before the coming of the bird ancestors. Feather-specific beta-keratin appeared later, about the time of Anchiornis.

The authors speculate that, since both alpha- and feather-specific beta-keratin appears in Anchiornis, the feathers may not have been mechanically stiff enough to support flight. This might be open to question because there are no modern feathers with both alpha- and beta-keratin and we cannot measure the stiffness of such a combination.

Sources:

Pan, Y.; Zheng, W.; Sawyer, R.H.; Pennington, M.W.; Zheng, X. Wang, X.; Wang, M.; Hu, L.; O’Conner, J.; Zhao, T.; Li, Z.; Schroeter, E.R.; Wu, F.; Xu, X.; Zhou, Z.; Schweitzer, M.H.
“The molecular evolution of feathers with direct evidence from fossils.”
Proc. Natl. Acad. Sci. 2019, 116, 3018-3023.

Schweitzer, M.H.; Zheng, W.; Moyer, A.E.; Sjovall, P.; Lindgren, P.
“Preservation potential of keratin in deep time.”
PLoS ONE, 2018, 13, e0206569.

King of the Dinosaur Hunters--A Review

Bob Sheridan March 12, 2019

Eight years ago I read and reviewed a biography "Barnum Brown. The Man Who Discovered Tyrannosaurus rex" by Lowell Dingus and Mark Norell. The authors are a Research Associate in Vertebrate Paleontology and Chair of Paleontology, respectively, at AMNH. Since the authors have access to the Museum archives, which includes correspondence between Brown and AMNH over decades, this is a very detailed biography. There is a great deal of information on which specimens were discovered where and who said what about them. There are also a number of photographs of these expeditions in the field. However, I did complain in my review that it was somewhat hard to find the big picture about Brown within all the detail. Description after description of expeditions got a little much for me after a while. I also would have liked some discussion of the scientific relevance of the specimens Brown excavated, but did not find much.

Dingus has a new biography "King of the Dinosaur Hunters," which covers John Bell Hatcher (1861-1904). Hatcher is one of the first field workers to excavate fossils in the American West having been hired by O.C. Marsh (Yale University) in 1884. He also collected fossils for Princeton University (most notably on an expedition to Patagonia), and the Carnegie Museum of Natural History. He is one of the first paleontologists to use a grid system to specify the exact location of fossils and one of the first to cover fossils with plaster jackets before removing them from the field. He is credited with discovering Triceratops and other horned dinosaurs, as well as describing (and mounting) the original Carnegie Diplodocus. Hatcher died suddenly of typhoid fever at age 42, but produced the founding collections of major museums.

As with "Barnum Brown," this is a very detailed biography centering mostly on the field work of the subject, with each expedition covered at the level of detail of how many boxes of fossils were sent back. Each chapter has many excerpts from letters to and from Hatcher. Obviously, this level of detail must be based on archives of personal material stored at various museums. There is an appendix of how many Hatcher specimens are in the collections of which museums.

I found this tough reading. "King of the Dinosaur Hunters" is an even more extreme version of "Barnum Brown," in the sense that there is even more detail about each individual expedition, and even less material about other aspects of the subject's life. There is very little about Hatcher's interactions with other paleontologists at the time, except those the reader infers from the letters. There is practically nothing about Hatcher's personal life, except where his letters mention that his wife or one of his children is sick. Finally, there is very little about the scientific significance of Hatcher's specimens. I was somewhat disappointed. "King of the Dinosaur Hunters" seems more a fossil catalog than a biography.

Sources:

Dingus, L.; Norell, M.A.
"Barnum Brown. The Man Who Discovered Tyrannosaurus Rex"
University of California Press, Los Angeles, 2010, 368 pages, $40 (hardcover)

Dingus, L.
"King of the Dinosaur Hunters. The Life of John Bell Hatcher and the Discoveries that Shaped Paleontology."
Pegasus Books, Ltd., New York, 2018, 520 pages, $35 (hardcover).

New Diplodocids

Bob Sheridan February 8, 2019

Diplodocids (named after Diplodocus) are a branch of sauropod dinosaurs with specialized features: very long necks and tails (sometimes including a "whip" at the end of the tail), highly sculpted neck vertebrae, long skulls with peg-like teeth at the very front, nostrils at the top of the head, etc. First discovered in North America, examples of diplodocids are found on most continents. They were most common in the Late Jurassic, but there are reports that some may have survived into the Early Cretaceous in South America. Diplodocids are among the longest sauropods, although, being lightly built, they are not the heaviest. This article reviews two new papers on diplodocids, both from the journal Nature Scientific Reports.

Cont'd

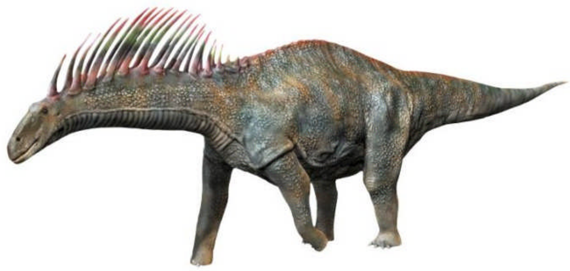
A paper by Woodruff et al. (2018) describes a new specimen CM VP14128 (Carnegie Museum) from the (Late Jurassic) Morrison Formation in Montana. The specimen consists of most of a skull (except the top region where the nasals would be), plus the front of the mandible, plus the first few cervical vertebrae. The quarry contains the remains of at least sixteen small diplodocids, but CM VP14128 is the only skull, although a second braincase is found also. (This by itself is interesting because the skulls of sauropods are rarely preserved.) CM VP14128 is the smallest known diplodocid skull so far at ~24 cm, but a close second is a previously described specimen from the Carnegie collection CM 11255 at ~29 cm. An adult Diplodocus skull is ~50 cm long. The authors estimate CM VP14128 would be about 4 meters long and 1 meter high at the shoulder; and adult would be 30 meters long and 4-5 meters at the shoulder.

Phylogenetic analysis using only cranial characteristics suggests CM VP14128 is a juvenile Diplodocus. Since this might be unreliable, it is hard to eliminate the possibility that it represents the juvenile of some other diplodocid, or, less likely, that it represents an adult dwarf species of diplodocid.

Assuming that CM VP14128 is a juvenile Diplodocus, one might conclude something about how Diplodocus matures. Whereas Diplodocus has peg-like teeth at the very front of the maxilla, CM VP14128 has peg-like teeth at the front, but also behind those teeth it has additional ~6 "spatulate" teeth. The dentary of CM VP14128 has 13 teeth while an adult Diplodocus has 11. The openings in the cervical centra of CM VP14128 vertebrae are smaller and simpler compared to those in an adult Diplodocus. The authors interpret this as the juvenile Diplodocus reflecting the characteristics of more primitive ancestral sauropods similar to Camarasaurus. They speculate that the difference in teeth indicates that juveniles ate a different diet than adults, for instance being browsers rather than grazers. Whether the difference in diet is obvious in retrospect depends on whether adult diplodocids ate at a reasonable height off the ground. It is still controversial whether they could raise their heads above their shoulders.

For the next story, a little background about Amargasaurus would be useful. Amargasaurus is a smallish (10 meters long) sauropod that belongs to the family of dicraeosaurs (named for Dicraeosaurus), which is a subtype of diplodocids. Amargasaurus, from the Early Cretaceous of Argentina, is unique in having the neural processes of about a dozen cervical vertebrae bifurcate and extend into very long rearward-pointing curved spines that extend over the back of the neck. Amargasaurus has been restored in a number of ways: with unadorned spines sticking out of the skin, with the spines being joined by webbed skin as in paired "sails", or with all the spines supporting a hump that is totally covered in skin. The function of these spines is speculated to be some kind of protection or some kind of display device.

Gallina et al. (2019) describe another dicraeosaurid from the Early Cretaceous of Argentina. This specimen consists of a snout, a mandible, the orbit, a braincase, and two cervical vertebrae. This specimen is ~15 Myr. older than Amargasaurus. The authors have given this animal the name Bajadasaurus (after the Bajada Colorada region in Argentina). The most unique aspect is that one of the cervical vertebrae (probably the fifth) bifurcates into two very long spines as in Amargasaurus, but in the case of Bajadasaurus the spines point forward.



One Restoration of Amargasaurus

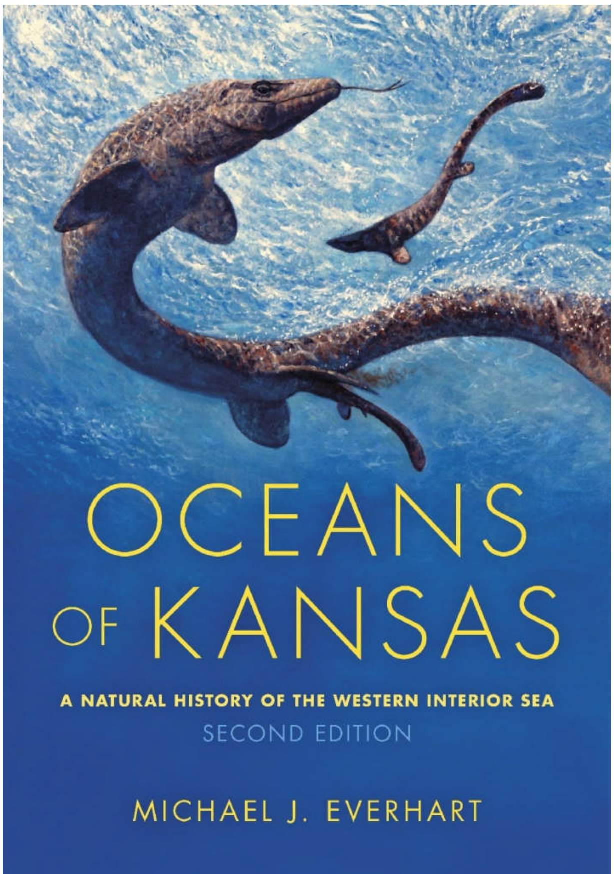
The authors speculate on how much keratin covering there would be on the spines, how resistant they would be to breaking, etc. This is in regard to evaluating a possible protective function of the spines. The authors restore the animal with a dozen forward-pointing spines by analogy with Amargasaurus. However, since only one vertebra with spines is actually preserved in the current specimen, it is hard to know how much protection would be afforded.

Sources:

Gallina, P.A.; Apesteguía, S.; Canale, J.I.; Haluza, A. A new long-spined dinosaur from Patagonia sheds light on sauropod defense system. Nature Scientific Reports, 2019, 9, 1392.

Woodruff, D.C.;Carr, T.D.; Storrs,G.W.; Waskow, K.; Scannella, J.B.; Nordén,K.K.; Wilson, J.P. The smallest diplodocid skull reveals cranial ontogeny and growth-related dietary changes in the largest dinosaurs. Nature Scientific Reports, 2018, 8, 14341.

Ads and events are listed here for free. They must be paleo related and are subject to editorial approval. Submissions can be sent to tomcagg@aol.com



The 2nd Edition of <u>*Oceans of Kansas – A Natural History of the Western Interior Sea*</u> will be available from Indiana University Press on September 11, 2017. The digital version is already available from Amazon. The second edition is updated with new information on fossil discoveries and additional background on the history of paleontology in Kansas. The book has 427 pages, over 200 color photos of fossils by the author (including Tom Caggiano's dinosaur bones in hand shot), is printed on acid free paper, and weighs in at a hefty 3.6 pounds.

A review from *Copeia*....

"Oceans of Kansas remains the best and only book of its type currently available. Everhart's treatment of extinct marine reptiles synthesizes source materials far more readably than any other recent, nontechnical book-length study of the subject."
—Copeia

https://www.coliseumshow.com/wp-content/uploads/2018/09/2018DenverColiseumShow-1.png

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Issues will be posted on the Journal page of the website.

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